Index Number:_____ IM05.24m

L-Università ta' Malta

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

INTERMEDIATE MATRICULATION LEVEL
2024 FIRST SESSION

SUBJECT:	**Biology**
DATE:	7th May 2024
TIME:	4:00 p.m. to 7:05 p.m.

Directions to Candidates

- Write your index number in the space at the top left-hand corner of this page.
- Answer **ALL** questions in Section A and **TWO** questions from Section B.
- Write all your answers to questions from Section A in the spaces provided in this booklet. Candidates are advised that under no circumstances should answers to Section A be submitted in the separate answer booklet provided.
- Write all your answers to questions from Section B in the separate answer booklet provided.
- If more than two questions from Section B are attempted, only the first two answers shall be taken into consideration.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated.
- You are reminded of the necessity for good English and orderly presentation in your answers.
- In calculations you are advised to show all the steps in your working, giving your answer at each stage.
- The use of electronic calculators is permitted.

For examiners' use only:

Question	1	2	3	4	5	6	7	8	9	10	**Total**
Score											
Maximum	**10**	**13**	**10**	**7**	**10**	**25**	**25**	**25**	**25**	**25**	**100**

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SECTION A: Answer ALL questions in this section.

1. This question concerns biomolecules.

Table 1.1 shows the nutritional information from a cereal bar.

Table 1.1 Nutritional information in a cereal bar

Type of molecule	Weight / g
Total Fat	3
Total Carbohydrates	30
Sugars	9
Protein	2

(Adapted from www.shipmesnacks.com)

a. From table 1.1 identify the type of molecule which:

i) Contains Nitrogen: _____ (1)

ii) Is made up of glycerol and 3 fatty acids: _____ (1)

b. i) Distinguish between carbohydrates and sugars.

_____

_____

_____ (2)

ii) Name a carbohydrate that is **not** a sugar: _____ (1)

c. A student crushes the cereal bar and dissolves it in water. She then adds a mixture of protease enzymes, which are enzymes that break down proteins completely.

i) Name the products formed when proteins are broken down completely.

_____ (1)

ii) Name the type of reaction that breaks down proteins. Give **ONE** reason for your answer.

Type of reaction: _____ (1)

Reason: _____ (1)

d. The student repeats the experiment under different conditions. Predict what happens to the rate of breakdown of proteins when the mixture of protease enzymes is boiled and cooled before adding it to the crushed cereal bar. Give **ONE** reason for your answer.

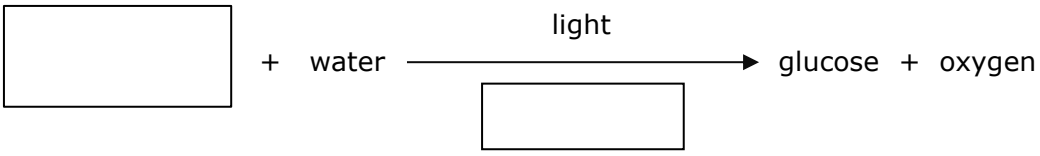
Prediction: _____ (1)

Reason: _____ (1)

(Total: 10 marks)

2. This question is about the process of photosynthesis.

a. The equation below summarizes the process of photosynthesis. Complete the equation by filling in the missing terms in the spaces provided:



(1)

b. Photosynthesis occurs in two stages: the light dependent stage and the light independent stage. Explain why the light dependent stage does **not** occur in the absence of light.

_____

_____

_____ (3)

c. Figure 1 below shows a cross-section of a chloroplast.

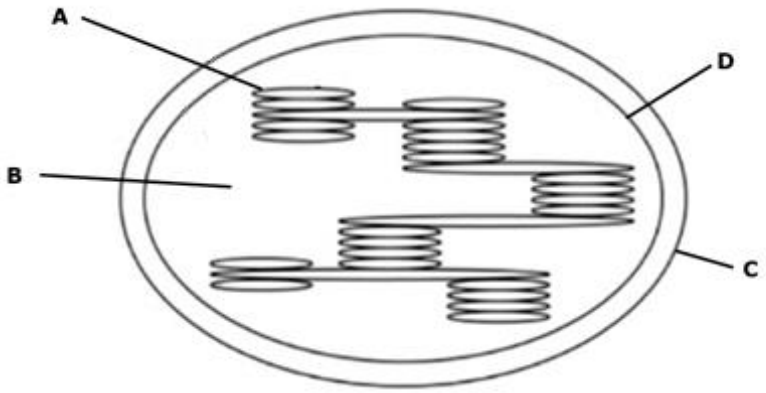


Figure 1: Cross-section of the chloroplast.

(Source: https://cdn.numerade.com)

i) Fill in the table below to give the name of structures A, B, C and D. (2)

Letter	Name
A	
B	
C	
D	

This question continues on the next page.

ii) Identify and explain **TWO** ways how the chloroplast is adapted to carry out photosynthesis.

_____

_____

_____

_____(4)

iii) The process of 'chloroplast dismantling' is observed in old leaves before these fall off a plant. The process involves the breaking down of chloroplasts. Describe what happens to the rate of photosynthesis in a leaf undergoing the process of chloroplast dismantling. Give **ONE** reason for your answer.

_____

_____

_____

_____ (3)

(Total: 13 marks)

3. This question is about human reproduction.

a. Describe **TWO** secondary sexual characteristics which develop in males and **TWO** in females. (2,2)

Male 1: _____

_____

Male 2: _____

_____

Female 1: _____

_____

Female 2: _____

_____

b. Distinguish between the processes of copulation and fertilisation.

_____

_____

_____ (2)

c. Fill in the table below to give the name of structures A, B and C shown in figure 2 and describe the importance of A and B in the development of C during pregnancy. (4)

Label code	Label Name	Importance of structure for the development of C
A		
B		
C		Not applicable

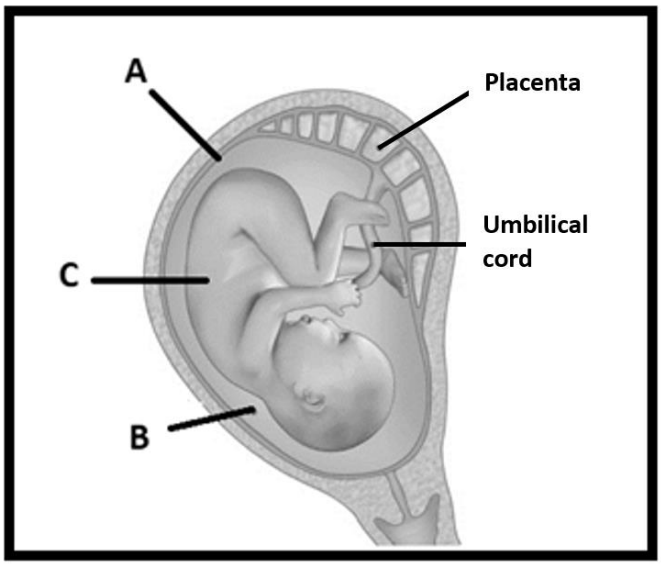


Figure 2: Development during pregnancy

(Source: https://www.inspq.qc.ca/en/tiny-tot/pregnancy/fetus/fetus-s-environment)

(Total: 10 marks)

Please turn the page.

4. This question is about the immune system.

a. X and Y (figure 3) are two molecules which must interact during an immune response.

i) What is molecule X? _____ (1)

ii) What is molecule Y? _____ (1)

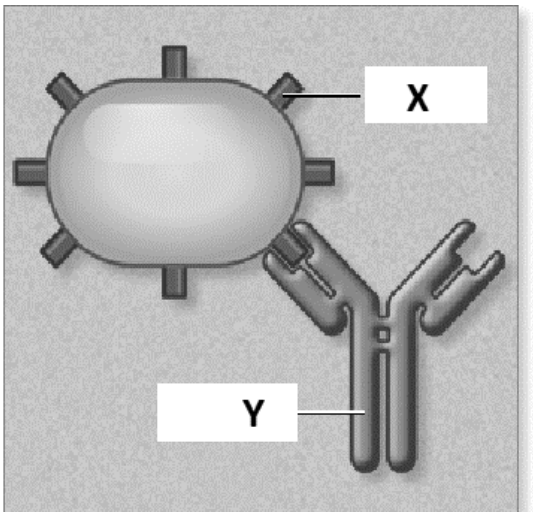


Figure 3: Molecules of the immune system
(Source:https://medlineplus.gov/ency/imagepages/9069.htm)

b. Which type of cell produces molecules of type Y?

_____ (1)

c. Where are these cells produced?

_____ (1)

d. Briefly describe how molecule X triggers the production of molecule Y.

_____

_____

_____

_____

_____ (3)

(Total: 7 marks)

5. This question is about cell division.

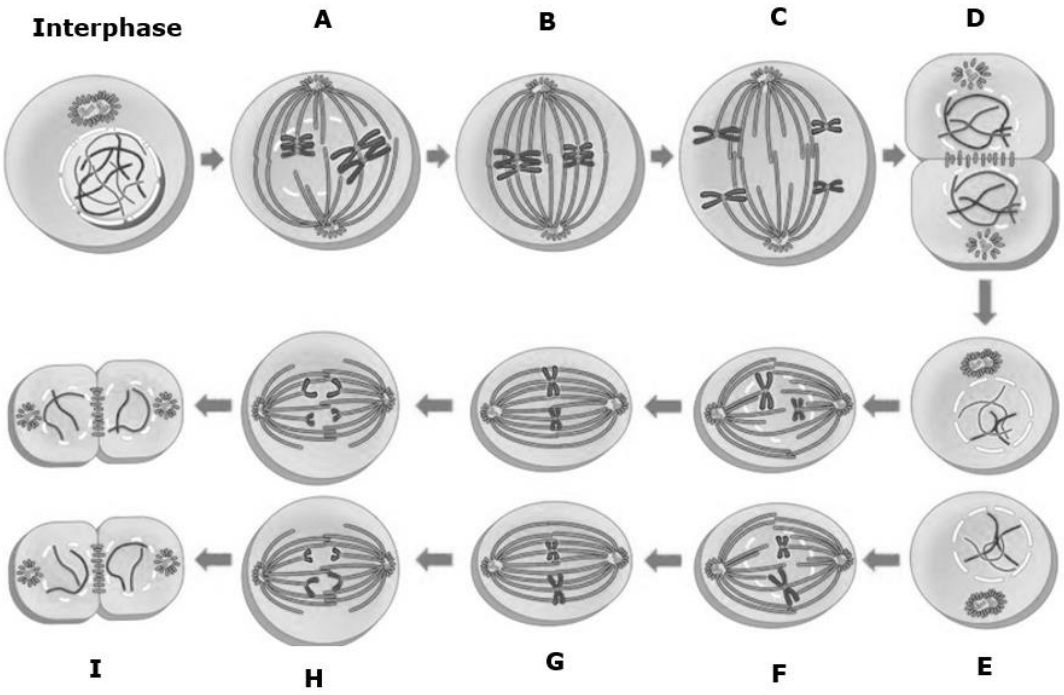


Figure 4: A process occurring during cell division
(Source: www.quizlet.com)

a. Name the type of cell division occurring in figure 4.

_____ (1)

b. On figure 4, interphase is labelled. State what happens during interphase.

_____

_____ (2)

c. During which stage A to I (if at all) do the following occur?

i) Pairing of homologous chromosomes: _____ (1)

ii) Crossing over: _____ (1)

iii) Independent assortment of chromosomes: _____ (1)

This question continues on the next page.

d. Does the process shown in figure 4 produce haploid or diploid cells? Using the figure explain how you arrived to your decision.

_____

_____

_____ (1, 2)

e. What is the significance of the process shown in figure 4?

_____

_____ (1)

(Total: 10 marks)

SECTION B:

Answer any TWO questions from this section; each question carries 25 marks. If more than two questions are attempted, only the first two answers shall be taken into consideration.
Write all your answers to questions from this section in the separate answer booklet provided.

6. This question is about homeostasis.

a. Define the term homeostasis. (2)

b. In the morning, a person starts the day with a carbohydrate rich breakfast.
   i) Explain why the glucose concentration in blood increases above the normal concentration 30 minutes after eating breakfast. (2)
   ii) Describe in detail how the body lowers the glucose level in blood back to normal. (8)

c. The same person eats a light snack at 6.00 pm before going to sleep. At 3.00 am, the blood glucose level decreases below the normal concentration. Describe in detail how the body increases the glucose level in blood back to normal. (6)

d. Give reasons for the following observations:
   i) A person waiting for a bus at noon in August has a very red face, but the same person waiting for a bus at noon in January has a very pale face. (5)
   ii) A cat is observed shivering after falling in pond filled with ice-cold water. (2)

(Total: 25 marks)

7. A team of scientists transferred few yeast cells into a flask containing glucose and other nutrients. They monitored the growth of the yeast cells for a few days and concluded that the population of yeasts showed a sigmoid growth pattern.

   a. i) Sketch a sigmoid growth curve and label the axes appropriately. (4)
   ii) On the curve sketched in part a(i), label the exponential growth phase, the transitional phase, and the plateau phase. (3)

   b. Describe the characteristics of each of the three phases observed in a sigmoid growth pattern. (8)

   c. Population size is affected by natality, mortality, emigration, and immigration.
   i) After reaching the plateau phase the population of yeast cells decreases until all cells are dead. Explain this phenomenon in terms of natality and mortality. (2)
   ii) Distinguish between the terms emigration and immigration and state how each affects population size. (3)

   d. i) Rotifers are organisms that may feed on yeast cells. Explain why a large population of yeast cells can only support a smaller population of rotifers. (2)
   ii) Sketch a pyramid of energy to show how energy is transferred from yeast cells to rotifers. (3)

(Total: 25 marks)

8. This question is about cellular respiration.

   a. The bacterial species *Eschericia coli* are facultative anaerobes, that is they can switch from aerobic to anaerobic respiration.
   State which environmental condition causes *Eschericia coli* to switch from aerobic to anaerobic respiration. (1)

   b. i) Glycolysis is the first stage of both aerobic and anaerobic respiration. Briefly describe what happens during this stage. (5)
   ii) Name the stages that follow glycolysis in aerobic respiration and briefly describe what happens during these stages. (6)
   iii) Explain why the growth rate of *Eschericia coli* is faster when the bacteria carry out aerobic respiration than when they carry out anaerobic respiration. (2)

   c. In anaerobic respiration, *Eschericia coli* change the final product of glycolysis to lactic acid. Describe how this happens and explain the significance of this conversion. (5)

   d. The rate of respiration reflects the metabolic rate of an organism. Indicate what happens to the metabolic rate of *Eschericia coli* if their environmental temperature decreases from 20 ^{o}C to 15 ^{o}C. Give **ONE** reason for your answer. (3)

   e. Mention and describe **TWO** other factors, other than temperature, that affect the metabolic rate. (3)

(Total: 25 marks)

Please turn the page.

9. This question is about the cell membrane.

   a. Draw a detailed diagram of the fluid mosaic model of the cell membrane. On the diagram label the following: phospholipids, cholesterol, glycoproteins, intrinsic proteins and extrinsic proteins. (10)

   b. Substances are able to cross the cell membrane in different ways.
      i) Some substances cross the membrane passively. Explain the meaning of passive transport and describe the two passive processes by which some substances cross the membrane. (5)
      ii) Other substances cross the membrane by active transport. Define active transport and give a detailed explanation of the process by which active transport across membranes takes place. (10)

(Total: 25 marks)

10. This question is about the circulatory system in humans.

   a. Draw a simple diagram of the heart. On the diagram label: left and right atria, left and right ventricles, vena cava, aorta, pulmonary artery, pulmonary vein, atrioventricular valves and semilunar valves. (10)

   b. Describe in detail the pathway of blood from the entry of blood into the heart through the vena cava to the exit of blood from the heart through the aorta. In your description explain whether blood is oxygenated or deoxygenated, and describe the role of the valves in the process. (10)

   c. Blood is a fluid medium. Describe the composition of blood and explain the role of blood in transport. (5)

(Total: 25 marks)

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